



# **WETTING BALANCE ANALYSIS TO COMPARE TWO STATIC SHIELD BAGS**

PREPARED FOR:

**DASAL TECHNICAL PRODUCTS, INC.**

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# Wetting Balance Analysis to Compare Two Static Shield Bags

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## **Background:**

Dasal Technical Products, Inc. (DTP) a distributor of Engineered Materials Inc. (EMI) products requested ACI's assistance in performing comparative studies of EMI's Intercept<sup>®</sup> Corrosions bags versus a competitive static/corrosion shield bag (Brand X). Since DTP needed to evaluate the protective nature of the Intercept<sup>®</sup> Corrosion bags it was determined that quantitative and qualitative solderability testing per J-STD-003A "Solderability Tests for Printed Boards" would be performed on standard plated coupons after being sealed in each bag type and exposed to a Salt-Fog chamber. The bags were provided directly to ACI from each supplier to assure an unbiased test.

## **Test Methods:**

Thirty silver plated copper coupons were obtained and sectioned from the support panel which they were attached to. The coupons were identified with a number and examined for scratches or anomalies in the plating surface prior to salt fog exposure (See Figures 1 and 2).

### *Salt Fog Exposure*

Ten coupons were sealed in Brand X static shielding bags and ten sealed in Intercept<sup>®</sup> anti-corrosion ESD bags. An Audion Electro Sealmaster 580-A bag sealer from West Coast Plastic Co was used and it was noted that for Brand X bags setting four gave the best seal while setting six worked best with the Intercept<sup>®</sup> bags. The twenty sealed bags along with five control coupons (unsealed) were inter dispersed through out the Harshaw model 300 Salt Fog chamber and exposed to seven consecutive days of salt fog per ACI procedure AP0210-1. At the end of the environmental stressing the bags were opened and the coupons examined visually for qualitative analysis of the corrosion if any present on the coupons (See Figures 3 through 27).

### Wetting Balance Test

- Inspection Equipment: Olympus model SZX12 optical microscope
- Dipping Mechanism: Kester<sup>®</sup> KWB-1000 Wetting Balance was used for the testing according to the designated test method as well as ACI laboratory procedure AP0270-2.
- Flux removal material: 99% Isopropyl alcohol (IPA)
- Solder: 63/37 tin/lead alloy solder from Kester<sup>®</sup>
- Flux: Rosin, mildly activated (RMA) Multicore Actiec 2

**Table 1. Wetting Balance Parameters.**

Parameter description	Test A
Pre-test specimen cleaning	None
Flux application, seconds	Dip, 3-5
Solder test receptacle	Bath
Solder temperature, °C	235
Height above solder surface at start of test, mm	10
Pre-heat	None
Immersion angle	90 deg
Immersion/Extraction speed, mm./sec.	3
Immersion depth, mm	4
Test duration, seconds	5

Each coupon was dipped in RMA flux prior to solder application via the Kester® KWB-1000 Wetting Balance. Any residue flux was removed with IPA before final inspection which was performed at a minimum of 10 X unless other wise stated. Table 2 summarizes the evaluation criteria.

**\*Table 2. J-STD-003A 4.3.1 Test F evaluation criteria.**

Parameter	Description	Set A	Set B
T <sub>0</sub>	Time to buoyancy corrected zero	≤ 1 second	≤ 2 seconds
F <sub>2</sub>	Wetting force at two seconds at start of test	**50% of maximum theoretical wetting force at or before two seconds	Positive value at or below two seconds
F <sub>5</sub>	Wetting force at five seconds at start of test	At or above the positive value of F <sub>2</sub>	At or above the value of F <sub>2</sub>

\* In addition to the criteria here J-STD-003 A requires that “the area of the test sample with fresh solder adhesion shall be greater than the area that was immersed in the solder bath (i.e. the printed board shall exhibit positive solder wetting beyond its immersion depth)”.

\*\* F<sub>(max at 50%)</sub> is 145 μN/mm.



### *Summary*

- The control samples became corroded upon exposure as expected (Figures 3 through 7).
- The coupons sealed in the Intercept<sup>®</sup> bags showed less corrosion than those coupons sealed in Brand X bags upon Salt Fog exposure (Figures 8 through 27).
- The coupons protected by the Intercept<sup>®</sup> bags wetted further with solder than those protected by Brand X bags (Figures 33 through 52).
- All the coupons analyzed failed the Wetting Balance for criteria A and B (See next bullet points which summarize these results and Figure 53 for reference).
- The time for the force to cross zero was in all cases greater than 2 seconds except one which appears to be an anomaly (trial 208).
- The force at 2 seconds in all cases was negative.
- The wetting force generated at 5 seconds for those coupons protected by the Intercept<sup>®</sup> bags was on average 183  $\mu\text{N}/\text{mm}$  while those protected by Brand X bags was 74  $\mu\text{N}/\text{mm}$ .

### *Prescreening*

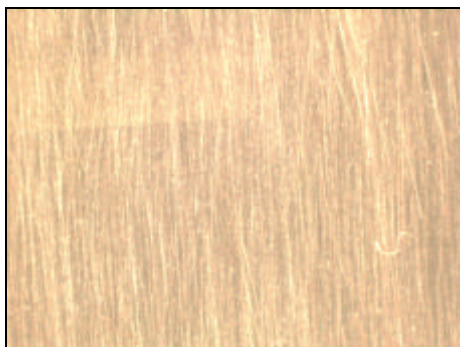


Figure 1 bare coupon prior to salt fog.



Figure 2 bare coupon prior to salt fog.

*Post Salt Fog exposure*

Control samples left exposed



Figure 3 Coupon #36.



Figure 4 Coupon #37.



Figure 5 Coupon #38.

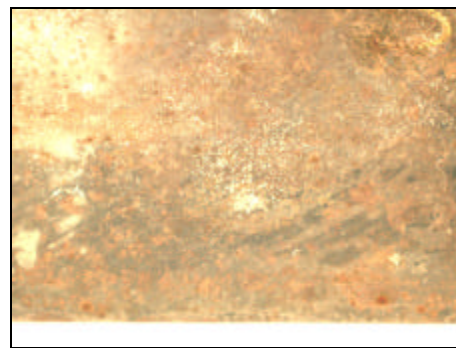


Figure 6 Coupon #39.



Figure 7 Coupon #40.

Samples sealed in Intercept<sup>®</sup> bags



Figure 8 Coupon #1.



Figure 9 Coupon #2.



Figure 10 Coupon #3.



Figure 11 Coupon #4.



Figure 12 Coupon #5.



Figure 13 Coupon #6.



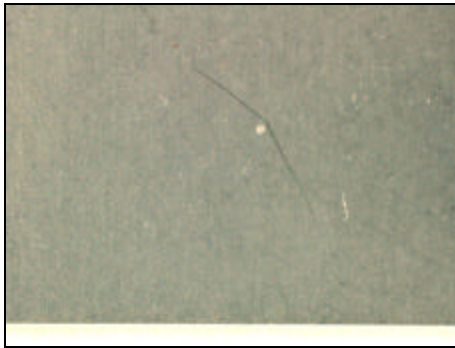


Figure 14 Coupon #7.



Figure 15 Coupon #8.



Figure 16 Coupon #9.



Figure 17 Coupon #10.

Samples sealed in Brand X bags



Figure 18 Coupon #16.



Figure 19 Coupon #17.





Figure 20 Coupon #18.

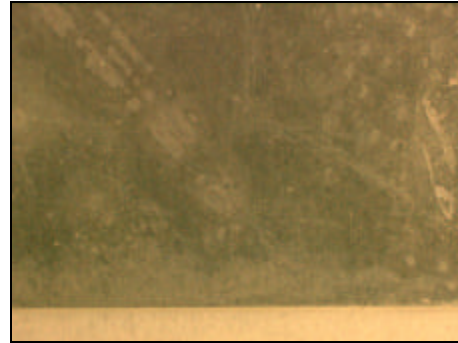


Figure 21 Coupon #19.



Figure 22 Coupon #20.



Figure 23 Coupon #21.



Figure 24 Coupon #22.



Figure 25 Coupon #23.



Figure 26 Coupon #24.



Figure 27 Coupon #25.

*Post Soldering*

Control samples left exposed



Figure 28 Coupon #36.



Figure 29 Coupon #37.



Figure 30 Coupon #38.



Figure 31 Coupon #39.



Figure 32 Coupon #40.

Samples sealed in Intercept<sup>®</sup> bags

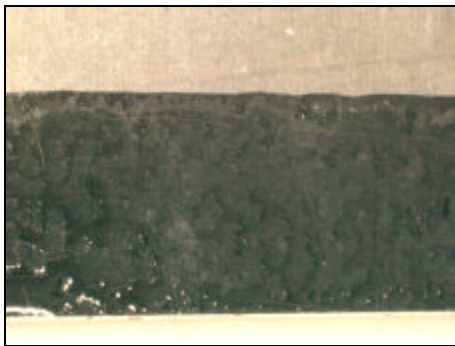


Figure 33 Coupon #1.



Figure 34 Coupon #2.

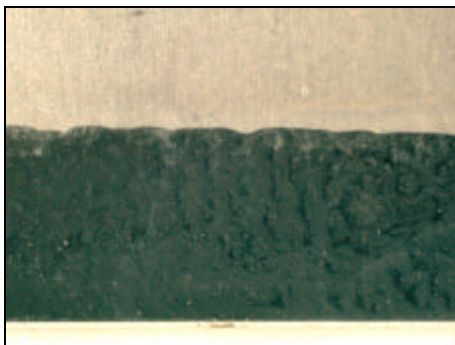


Figure 35 Coupon #3.



Figure 36 Coupon #4.



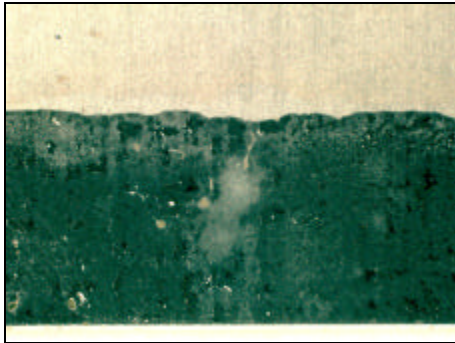


Figure 37 Coupon #5.

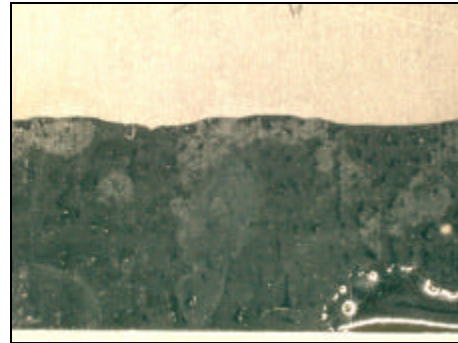


Figure 38 Coupon #6.

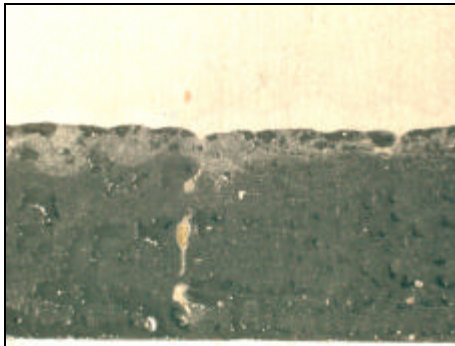


Figure 39 Coupon #7.



Figure 40 Coupon #8.

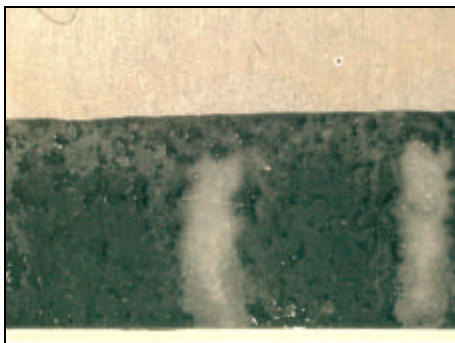


Figure 41 Coupon #9.

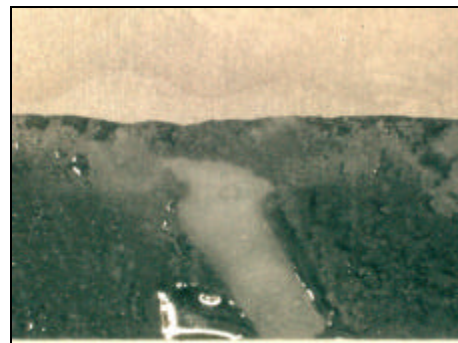


Figure 42 Coupon #10.

Samples sealed in Brand X bags



Figure 43 Coupon #16.



Figure 44 Coupon #17.



Figure 45 Coupon #18.



Figure 46 Coupon #19.



Figure 47 Coupon #20.



Figure 48 Coupon #21.



Figure 49 Coupon #22.



Figure 50 Coupon #23.

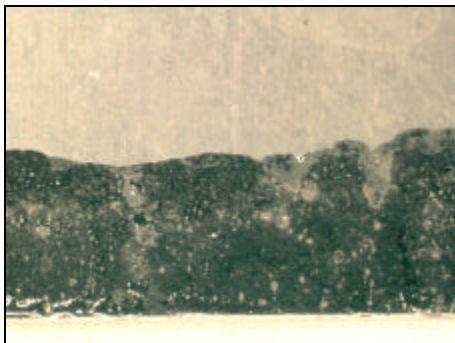


Figure 51 Coupon #24.

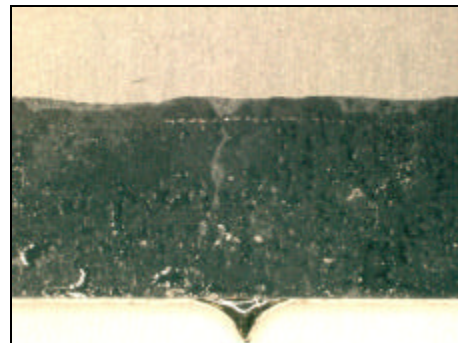


Figure 52 Coupon #25.

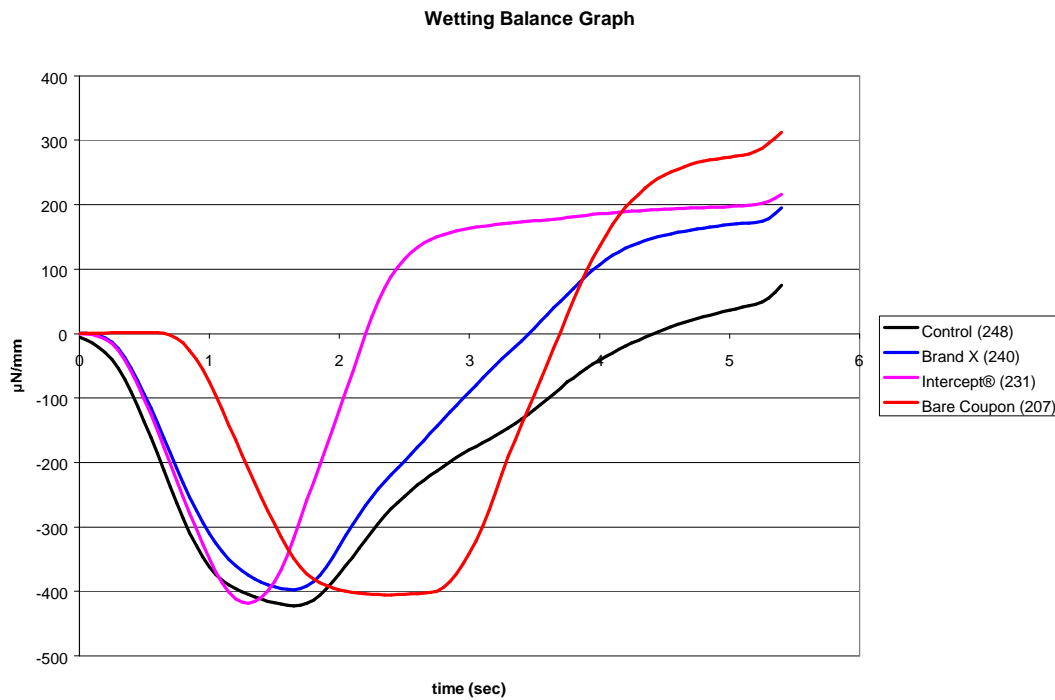


Figure 53 The best example (trial #) wetting balance graphs for coupons from each scenario

**Conclusions:**

The results of the qualitative and quantitative solderability testing performed indicates the Intercept<sup>®</sup> anti-corrosion ESD bags provide better protection from corrosion than Brand X’s static shield bags. The coupons which were stored in the Intercept<sup>®</sup> bags indicated less observable corrosion and wetted to the surface more uniformly than those stored in Brand X bags and were wet-able equal to the immersion depth in most cases unlike the coupons stored in Brand X bags. In most instances the coupons protected by the Intercept<sup>®</sup> bags soldered with 95% or greater coverage with minimal pin holes or anomalies. The coupons stored in Brand X bags did show de-wetting or non wetting in most cases when soldered.

**Recommendations:**

The salt fog chamber temperature is approximately 95°F. As a result, it may be worth repeating the solderability testing after temperature cycling or elevated temperatures. ACI can perform such testing routinely.